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# Ideas for New Format of Range Meteorological Data

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5 February 2016

# Outline

- Background / Motivation
- General Format Updates
- Wind Tower Format Updates
- Balloon Format Updates
- 915 MHz Doppler Radar Wind Profiler (DRWP) Format Updates
- 50 MHz DRWP Format Updates
- Questions

# Background

- The Meteorological Data Transfer Format (MDTF) has been used by NASA, the Air Force, and others since 1989 to provide data for space vehicle design, day of launch support, and the building of local climatologies.
- MDTF offers a unique format including units and character formatting for each data source, such as:
  - Towers (WT)
  - Low Resolution Flight Element (LR)
  - Winds Only Low Resolution Flight Element (LW), High Resolution (HR), Jimsphere (JS)
  - 50 MHz Doppler Radar Wind Profiler (DRWP) (PS)
  - 915 MHz DRWP (RW)
- Additionally, MDTF was designed so that files would be readable to users and easy to analyze with the FORTRAN programming language.

# Motivation

- Conversations arose from the Range Commander's Council Meteorology Group (RCC MG) discussing the limitations of MDTF, which come from MDTF being designed for older technologies.
- Engineers and analysts could benefit from updating data formats to take advantage of modern technology.
- This presentation proposes, from a Marshall Space Flight Center (MSFC) Natural Environments (NE) perspective, general updates to optimize the efficiency of the format and how the community as a whole could benefit.

# General Format Updates

Current MDTF:

- Text format, limited to 80 character columns.

Updates:

- Keep the files formatted as text files. This provides readability for users.
- Remove the 80 character column limit.
- Space delimits separate fields.

Benefits:

- Data from a singular record will be one line, improving the efficiency to read a file by software or user.
- Space delimiters take advantage of other methods of reading and parsing data from a line found in MATLAB and Python.

# Tower Format Updates

Current MDTF for Towers:

- Each line contains data from a specific height from a tower.
- If no data exists, field is filled with white space or 999 depending on tower instrumentation availability.

Updates:

- Each line would contain data from all heights from one tower (i.e. one tower per line).
- Keeping consistent with space delimited values, values of no data would be represented with either “-999” (the parameter cannot be measured) or “-888” (the parameter can be measured, but the instrument failed).

Benefits:

- Data from a singular record will be one line, improving the efficiency to read a file.
- Using characters to represent values of no data, can be easily programmed as “NaN” in Python, MATLAB, and IDL. Also, this maintains the use of space delimiters. Two different no data values can provide information regarding the capability of towers.

# Balloon Format Updates

Current MDTF for Balloons:

- There are two types of MDTF balloon formats:
  - LR, which contains thermal data
  - Winds Only (LW, HR, JS)
- In addition to 100 and 1,000 foot data, mandatory and significant levels are included in LR files.

Updates:

- Combine fields from both MDTF balloon formats, thus, there is only one balloon format.
- Keep mandatory and significant level data at end of file?

Benefits:

- One read routine could be written for all currently used balloons.
- Possible disadvantage: In a winds only file, there will be a lot of “-999” values.

# 915 MHz DRWP Format Updates

Current MDTF for 915 MHz DRWP:

- Meta-data in header and data in main body of file have no descriptive text.
- Meta-data and data are split across two lines several times throughout the file.

Updates

- Add lines of descriptive text for each parameter of meta-data and one line of descriptive text before the main body of data.
- If a group of meta-data is split over two lines, print similar groups of meta-data on the same line. In the main body of data, print all data from one height on one line of text.

Benefits:

- Names and units for meta-data and data will greatly improve understanding of content of 915 MHz DRWP files.
- Data from a singular record will be one line, improving the efficiency to read a file.

# 50 MHz Format Updates

Current MDTF for 50 MHz DRWP:

- Additional space in between every line of data in the main body of the file.
- Data is formatted to be column specific.

Updates:

- Remove extra blank lines from main body of file.
- Include spaces between each field.

Benefits:

- Programming is more efficient when data is organized in consecutive lines.
- Space delimiters take advantage of easier methods of reading and parsing data from a line found in MATLAB and Python.

# Other Questions and Discussions

- What are other possible changes to improve efficient use of data?
- Use the same units on all data?
- How should any future instruments be introduced to a new format?

# Backup

Proposed New Data Formats

# Back up: Towers

WT012722020
CCAFS/KSC WIND TOWER DATA 2020Z 29 SEP 15

| TOWER | HGT | AV | 01 MIN AVERAGE DIR | 01 MIN AVERAGE SPD | 01 MIN PEAK DIR | 01 MIN PEAK SPD | 10 MIN PEAK DIR | 10 MIN PEAK SPD | DEV | TMP | DIF | DP | RH | PRE | HGT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FT | MIN | DEG | KTS | DEG | KTS | DEG | KTS | DEG | F | F | F | % | MB | FT |
| 0397 | 132 | 01 | 170 | 11 | 170 | 13 | 170 | 13 | 007 | 79.3 | -999.0 | 76.1 | 90 | -999.0 | 133 |
| 0040 | 54 | 01 | -888 | -888 | -888 | -888 | -888 | -888 | -888 | -999.0 | -999.0 | -999.0 | -99 | -999.0 | -999 |

# Back up: Balloons

LW012740515
LO-RES AMPS WIND DAT CCAFS
0515Z 01 OCT 15

| ALT GEOMFT | DIR DEG | SPD KTS | SHR /SEC | ASCENT F/S | TEMP DEGC | DPT DEGC | PRESS MBS | RH PCT | ABHUM G/M3 | DENSITY G/M3 | I/R N | V/S KTS | VPS MBS | PW MM | DATA QUALITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 10 | 6.0 | .999 | 99.9 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 0 |
| 100 | 5 | 7.9 | .999 | 99.9 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 0 |
| 200 | 3 | 9.7 | .050 | 19.6 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 1 |
| 300 | 5 | 10.8 | .019 | 22.2 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 1 |
| 400 | 12 | 10.9 | .024 | 20.4 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 1 |
| 500 | 20 | 11.0 | .026 | 20.4 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | -999 | 1 |

…
TERMINATION 60000 GEOPFT 18288 GEOPM -999 MBS
TROPOPAUSE -999 FEET -999 MB -999 C -999 C

LR012722350
RAWINSONDE AMP/LR CCAFS
2350Z 29 SEP 15

| ALT GEOMFT | DIR DEG | SPD KTS | SHR /SEC | ASCENT F/S | TEMP DEGC | DPT DEGC | PRESS MBS | RH PCT | ABHUM G/M3 | DENSITY G/M3 | I/R N | V/S KTS | VPS MBS | PW MM | DATA QUALITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 210 | 4.0 | -888 | -999 | 27.5 | 25.9 | 1008.80 | 91 | 24.09 | 1154.28 | 398 | 680 | 33.42 | 0 | -999 |
| 1000 | 246 | 16.4 | .023 | -999 | 25.3 | 22.0 | 975.32 | 82 | 19.16 | 1126.81 | 364 | 677 | 26.39 | 6 | -999 |
| 2000 | 270 | 15.6 | .011 | -999 | 23.2 | 20.9 | 942.16 | 87 | 18.03 | 1096.59 | 351 | 674 | 24.66 | 12 | -999 |
| 3000 | 276 | 16.8 | .004 | -999 | 21.3 | 19.6 | 909.92 | 90 | 16.84 | 1066.31 | 338 | 672 | 22.88 | 17 | -999 |
| 4000 | 290 | 18.2 | .007 | -999 | 19.6 | 18.1 | 878.55 | 91 | 15.35 | 1036.14 | 323 | 670 | 20.74 | 22 | -999 |
| 5000 | 284 | 19.8 | .004 | -999 | 18.0 | 17.2 | 848.10 | 95 | 14.61 | 1005.90 | 312 | 668 | 19.63 | 27 | -999 |

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TERMINATION 24934 GEOPFT 7600 GEOPM 400.8 MBS
TROPOPAUSE 0 FEET .00 MB .0 C .0 C

# Back up: 915 MHz DRWP

RWP0001
Lat(deg): 28.40
Lon(deg): 80.60
AltD(m): 3
ConDateTime: 15 09 29 16 00 0
TdiffMin: 0
ConAvgMin: 14
NumRecs: 10 10 9 0 0
NumReqRecs: 6 6 6 0 0
AccRange(m/s): 2.00 2.00 3.00 0.00 0.00
CohInt: 170 170
NumSpcAvg: 42 42
PulseWid(n/s): 1400 1400
IntPulse(n/s): 47 47
NyqVel(m/s): 10.3 10.3
1stGateDly(ns): 2100 2100
NumRngGt: 60 60
RngGtSpc(ns): 700 700
CorrInd: 1
Azi(deg): 91 1 0 0
Ele(deg): 75 75 0 0

| Alt | Spd | Dir | RV1 | RV2 | RV3 | RV4 | RV5 | NR1 | NR2 | NR3 | NR4 | NR5 | SNR1 | SNR2 | SNR3 | SNR4 | SNR5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Km | m/s | Deg | m/s | m/s | m/s | m/s | m/s | N/A | N/A | N/A | N/A | N/A | dB | dB | dB | dB | dB |
| 0.130 | 5.9 | 181 | 0.00 | 0.00 | -1.50 | -888 | -888 | 9 | 10 | 10 | -888 | -888 | 13 | 11 | 15 | -888 | -888 |
| 0.231 | 6.1 | 187 | 0.00 | -0.10 | -1.60 | -888 | -888 | 9 | 10 | 10 | -888 | -888 | 12 | 12 | 15 | -888 | -888 |
| 0.332 | 6.3 | 192 | 0.10 | -0.30 | -1.60 | -888 | -888 | 9 | 10 | 10 | -888 | -888 | 9 | 9 | 12 | -888 | -888 |

# Back up: 50 MHz DRWP

PS072731210
PROFILER DATA KSCER
1209Z 30 SEP 15

| ALT GEOM | DIR DEG | SPD M/S | SHR /SEC | WW M/S | S1 DB | S2 DB | S3 DB | N1 DB | N2 DB | N3 DB | WID1 M/S | WID2 M/S | WID3 M/S | G 1 | G 2 | QC NN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1798 | 234 | 14.0 | .000 | -0.12 | 111.5 | 109.9 | 110.8 | 62.0 | 62.6 | 62.3 | 0.8 | 0.5 | 0.64 | 0 | 0 | 64 |
| 1948 | 233 | 14.0 | .001 | -0.06 | 115.0 | 114.6 | 114.8 | 62.1 | 62.7 | 62.4 | 0.9 | 0.5 | 0.70 | 0 | 0 | 64 |
| 2098 | 238 | 14.3 | .008 | -0.19 | 117.7 | 117.3 | 117.5 | 60.5 | 61.2 | 60.9 | 0.9 | 0.5 | 0.68 | 0 | 0 | 64 |
| 2247 | 242 | 14.4 | .006 | -0.18 | 118.0 | 113.5 | 116.3 | 61.3 | 61.9 | 61.6 | 0.7 | 0.5 | 0.60 | 0 | 0 | 64 |
| 2397 | 244 | 14.4 | .004 | -0.09 | 118.7 | 117.2 | 118.0 | 62.2 | 62.6 | 62.4 | 0.9 | 0.5 | 0.70 | 0 | 0 | 64 |